

Avian Oncoviruses: A Threat to the Poultry Industry

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The dramatic increase in urbanization and rise in human population with improved economic status and lifestyle has increased the demand manifolds for poultry egg and meat. Poultry has become an important food source and agricultural commodity worldwide. The poultry farming has witnessed a boom and become the fastest growing sector of India's agriculture during last two decades. The production of eggs and broilers has been rising at a rate of 8 to 10 percent per annum. A significant feature of India's poultry industry has been its transformation from a mere unorganized, small-scale backyard farming into large-scale, organized commercial venture today. Rapid growth of poultry industry is driven by a combination of rising incomes, young and urbanizing population, improved lifestyle and declining real poultry prices relative to other goods.

The flourishing poultry industry having intensive growth coupled with global trade of hatching eggs, birds, poultry meat, and vaccines etc., at the same time has also resulted in emergence and re-emergence of very virulent/aggressive strains of various pathogens. Viral pathogens particularly those with ribonucleic acid (RNA) genomes have the highest rate of efficient and fast replication. They are highly susceptible to the development of point mutations during replication of the genome very easily due to genetic instability and variability. At the beginning of 20th century, the flourishing poultry industry gave birth to oncogenic viral diseases such as Marek's Disease and Avian leukosis virus (ALV) causing mortality and huge economic loss to the developed poultry industry even until today.

Avian Leukosis virus (ALV), the most common naturally occurring avian C type retrovirus containing subgroups A to J is recently placed on List C of the Food and Agriculture Organization Animal Health Yearbook, 1995. Avian Leukosis, commonly known as Avian leukosis complex (ALC) is a variety of neoplastic disease conditions in chickens such as lymphoid leukosis, myeloblastosis, erythroblastosis, osteopetrosis, myxosarcomas, fibrosarcomas and other tumours. They were the first neoplastic diseases in any species to be shown, 100 years ago, to be transmissible and caused by viruses, and have consequently been studied extensively by biomedical scientists as models for the role of viruses in cancer.

Oncogenes of avian retroviruses that cause leukosis and other tumours having their origin from proto-oncogenes in normal host cells are involved in cancer in many species, including chickens and humans. Understanding the relationship between viral latency and transformation stages still remains a major diagnostic challenge for the ALV system for both veterinarian and biomedical scientists. The highly oncogenic nature of ALV-particularly the mechanisms of protection, viral replication, pathogenesis and molecular biology are not completely understood which makes it an excellent model for studying the transformation of lymphocytes and the metastasis of lymphoid tumors in humans and other animals. Control of the disease by the use of vaccines against ALV has not been very successful partly because of the immunological tolerance against the virus seen in some birds. Despite implementation of several eradication programmes and development of breeding lines of chickens resistant to the disease by several breeding companies have been an enormous success but were

not suitable for eradication of ALV infection on a commercial scale. New and more virulent strains continue to emerge because of substantial genetic and antigenic variation among ALV isolates as well as high levels of vertical and horizontal transmission. In recent years, the pathological lesions of myeloid leukosis, hemangioma and hemangiosarcoma suggestive of a newly evolved pathotype ALV-J infection in commercial layers, broiler breeders and commercial broilers have been emerging in India. These viruses are immunosuppressive in addition to oncogenic and causes increased susceptibility to other concurrent infections. ALV-induced immunosuppression involving humoral, cell-mediated immunity and other nonspecific immunities is thought to be mainly associated with apoptosis and necrosis of lymphocytes.

Marek's Disease Virus (MDV) exhibits a tremendous adaptability to changes in its environment. They can escape from selective pressures by mutations. An exceptional capability of these viruses is the uptake of genes from the host organism and the use for own purposes. One or several of these adaptation mechanisms may have led to the appearance of oncogenic properties of the virus. A unique attribute of MDV replication is its strict cell associated nature during replication both in tissue culture cells and during in vivo replication in lymphocytes. Understanding the relationship between viral latency and transformation stages still remains a major diagnostic challenge for the MDV system. Marek's Disease, recently classified as OIE list B disease is a highly contagious oncogenic and neuropathic devastating disease of chickens responsible for great economic losses to the poultry industry all around the world and characterized by development of CD4+T cell lymphomas as well as infiltration of nerves and visceral organs by lymphocytes. Though the development of effective vaccines and breeding lines of chickens resistant to the disease have been an enormous success, but new and more virulent strains continue to emerge till today. The evolving highly pathogenic isolates of MDV around the world are capable of overcoming the protection from currently employed vaccines. The existing vaccines may drive the pathogen to more and more virulence and also of much concern because of possible interspecies transfer to humans. MD is also an immunosuppressive disease and causes increased susceptibility to other concurrent infections. Immunosuppression, which is considered to be an integral aspect of MD pathogenesis that ultimately leads to the death of many chickens in a number of cases. MDV-induced immunosuppression, involving both humoral and cell-mediated immunity, is thought to be mainly associated with lymphopaenia due to the cytolysis of B and T lymphocytes. The degree of immunosuppression is also a criterion of virulence of emerging strains. Detection of MD-induced immunosuppression is also an important diagnostic challenge.

Oncogenic viral diseases pose a big challenge to the welfare and wellbeing of the poultry with increased condemnation of carcass, loss of productivity and quality products leading to huge economic losses inspite of ubiquitous vaccination of the chickens which needs to be attended and preventive programmes are required to be implemented. Effective preventive measures with prompt diagnostic procedure is of prime importance for this life threatening disease. An early and accurate diagnosis and evaluating its pathogenesis at a molecular level will give a better understanding of the nature of disease for the benefit of the scientific fraternity, poultry farmers, veterinary practitioners, students, researchers and diagnosticians which in turn help in prognosis, the better and effective management and ultimately control of the disease [1-9].

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